

Appl. No. 10/699,440  
Amdt. dated January 10, 2006  
Reply to Office action of December 13, 2005

**Amendments to the Claims:**

The listing of present claims in the application:

**Listing of Claims:**

1 Claim 1 (Original): A film surface imprinted with nanometer-sized  
2 particles to produce micro- and/or nano-structured electron and  
3 hole collecting interfaces, comprising;  
4 at least one transparent substrate;  
5 at least one photoabsorbing conjugated polymer applied on a  
6 first said substrate, wherein said conjugate polymer includes  
7 polybutylthiophene (pbT);  
8 a sufficient amount of nanometer-sized particles including  
9 multiwalled carbon nanotubes (MWNT) to produce a charge  
10 separation interface;  
11 at least one transparent polymerizable layer including a  
12 sol-gel or monomer,  
13 said MWNT embedded in said conjugated polymer to produce a  
14 mixture and applied on a second said substrate to form a MWNT  
15 bearing surface film layer to form a stamp surface;  
16 wherein said stamp surface is imprinted into the surface of  
17 said polymerizable film layer to produce micro- and/or nano-  
18 structured electron and hole collecting interfaces;  
19 polymerizing said polymerizable film layer to promote  
20 shrinkage to form a conformal gap between said MWNT stamp surface

21 and said surface of said polymerizable film layer; and  
22 filling said gap with at least one photoabsorbing material  
23 to promote the generation of photoexcited electrons and transport  
24 to the charge separation interface.

1 Claim 2 (Original): The film according to claim 1, wherein either  
2 said polymerizable layer and said conjugated polymer is applied  
3 by processes comprising at least one of spin-coating, dip-  
4 coating, spray-coating, flow-coating, doctor blade coating, and  
5 screen-printing.

1 Claim 3 (Original): The film according to claim 1, wherein said  
2 nanometer-sized particles having average particle sizes of about  
3 1 nm to about 100 nm in diameter and up to about 1 nm to about 1  
4 cm in length.

1 Claim 4 (Original): The film according to claim 3, wherein said  
2 nanometer-sized particles having average particle sizes of about  
3 1 nm to about 100 nm in diameter and up to about 1 nm to about  
4 500 nm in length.

1 Claim 5 (Original): The film according to claim 1, wherein said  
2 nanometer-sized particles further comprises at least one of SWNT,  
3 and nanocrystals of semiconductor materials.

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1 Claim 6 (Original): The film according to claim 5, wherein said  
2 nanocrystals of semiconductor materials comprises at least one of  
3 CdSe, metal nanowires, and metal-filled carbon nanotubes.

1 Claim 7 (Original): The film according to claim 1, wherein  
2 applying said polymerizable film layer ranging in thickness from  
3 about 1 nm to about 1 mm.

1 Claim 8 (Original): The film according to claim 1, wherein  
2 applying said conjugated polymer mixture ranging in thickness  
3 from up to about 100 nm.

1 Claim 9 (Original): The film according to claim 1, wherein said  
2 polymerizable layer comprises at least one monomer film.

1 Claim 10 (Original): The film according to claim 1, wherein said  
2 polymerizable layer comprises at least one sol-gel film.

1 Claim 11 (Original): The film according to claim 1, wherein said  
2 sol-gel includes absolute alcohol and ultrapure water in a ratio  
3 of about (1:0.025) and said metal oxide includes titanium oxide  
4 and/or zinc oxide.

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1 Claim 12 (Original): The film according to claim 1, wherein said  
2 monomer comprising at least one of oxadiazole, aniline, and  
3 pyrrole.

1 Claim 13 (Original): The film according to claim 1, wherein said  
2 photoabsorbing material comprises at least one of thermotropic  
3 liquid crystalline materials, polybutylthiophene  
4 (pbT)/chlorobenzene, and polyelectrolytes.

1 Claim 14 (Original): A film surface imprinted with nanometer-  
2 sized particles prepared by a process to produce micro- and/or  
3 nano-structured electron and hole collecting interfaces,  
4 comprising:  
5       providing at least one transparent substrate;  
6       providing at least one photoabsorbing conjugated polymer;  
7       providing a sufficient amount of nanometer-sized particles  
8       to produce a charge separation interface;  
9       providing at least one transparent polymerizable layer  
10      including a sol-gel or monomer;  
11      embedding said nanometer-sized particles in said conjugated  
12      polymer;  
13      applying said polymerizable layer on a first said substrate  
14      to form a charge transport film layer;

15           applying said conjugated polymer/nanometer-sized particle  
16           mixture on a second said substrate to form a nanometer-sized  
17           particles bearing surface film layer, wherein said nanometer-  
18           sized particles form a stamp surface;

19           imprinting said stamp surface into the surface of said  
20           polymerizable film layer to produce micro- and/or nano-structured  
21           electron and hole collecting interfaces;

22           polymerizing said polymerizable film layer to promote  
23           shrinkage to form a conformal gap between said stamp surface and  
24           said surface of said polymerizable film layer; and

25           filling said gap with at least one photoabsorbing material  
26           to promote the generation of photoexcited electrons and transport  
27           to the charge separation interface.

1           Claim 15 (Original): The film according to claim 14, wherein said  
2           imprinting includes compressing and thereafter, solidifying said  
3           stamp surface into said surface of said polymerizable layer.

1           Claim 16 (Original): The film according to claim 14, wherein said  
2           nanometer-sized particles having average particle sizes of about  
3           1 nm to about 100 nm in diameter and up to about 1 nm to about 1  
4           cm in length.

1           Claim 17 (Original): The film according to claim 16, wherein said

2 nanometer-sized particles having average particle sizes of about  
3 1 nm to about 100 nm in diameter and up to about 1 nm to about  
4 500 nm in length.

1 Claim 18 (Original): The film according to claim 14, wherein said  
2 nanometer-sized particles further comprises at least one of SWNT,  
3 and nanocrystals of semiconductor materials.

1 Claim 19 (Original): The film according to claim 18, wherein said  
2 nanocrystals of semiconductor materials comprises at least one of  
3 CdSe, metal nanowires, and metal-filled carbon nanotubes.

1 Claim 20 (Original): The film according to claim 14, wherein  
2 applying said polymerizable film layer ranging in thickness from  
3 about 1 nm to about 1 mm.

1 Claim 21 (Original): The film according to claim 14, wherein  
2 applying said conjugated polymer mixture ranging in thickness  
3 from up to about 100 nm.

1 Claim 22 (Original): The film according to claim 14, further  
2 comprising electrophoretically depositing said nanometer-sized  
3 particles onto said polymerizable layer.

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1 Claim 23 (Original): The film according to claim 22, wherein said  
2 nanometer-sized particles include TiO<sub>x</sub> nanometer-sized particles.

1 Claim 24 (Original): The film according to claim 14, wherein said  
2 sol-gel includes absolute alcohol and ultrapure water in a ratio  
3 of about (1:0.025) and a metal oxide.

1 Claim 25 (Original): The film according to claim 24, wherein  
2 said metal oxide comprises at least one of inorganic metal salts  
3 and metal organic compounds.

1 Claim 26 (Original): The film according to claim 25, wherein  
2 said metal organic compounds include metal alkoxides comprising  
3 at least one of titanium isopropoxide and zinc butoxide.

1 Claim 27 (Original): The film according to claim 14, wherein  
2 said monomer comprising at least one of oxadiazole, aniline, and  
3 pyrrole.

1 Claim 28 (Original): The film according to claim 14, wherein  
2 said substrate acts as an electrode by comprising a coating of at  
3 least one transparent metal oxide including SnO<sub>2</sub>:F, SnO<sub>2</sub>:In  
4 (ITO), and Au.

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1 Claim 29 (Original): The film according to claim 14, wherein  
2 said substrate acts as an electrode by comprising a coating of at  
3 least one transparent metal oxide being conducting polymers  
4 including polythiophenes, polypyrroles, polyanilines, and  
5 polybutylthiophenes.

1 Claim 30 (Original): The film according to claim 14, wherein  
2 said conjugated polymer includes pbT dissolved in chlorobenzene.

1 Claim 31 (Original): The film according to claim 14, wherein  
2 said photoabsorbing material comprises at least one of  
3 thermotropic liquid crystalline materials, polybutylthiophene  
4 (pbT)/chlorobenzene, and polyelectrolytes.

1 Claim 32 (Original): The film according to claim 14, wherein  
2 said substrate comprises at least one of silicon, silicate,  
3 plastic, and plastic-like materials.

1 Claim 33 (Original): The films surface imprinted with nanometer-  
2 sized particles are obtained by the process defined in claim 14.

1 Claim 34 ((Original): The film according to claim 1, wherein said  
2 film being utilized in a photovoltaic device or other light  
3 guiding device.



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Claim 35 (canceled).

Claim 36 (canceled).